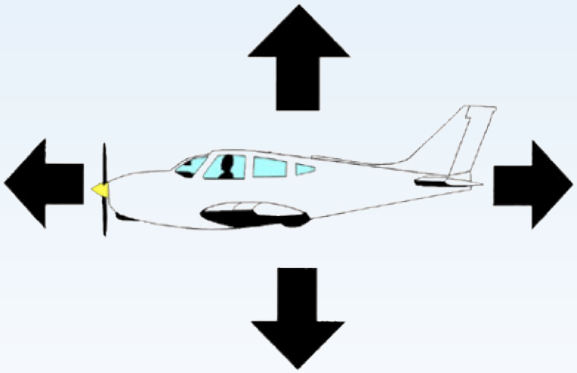
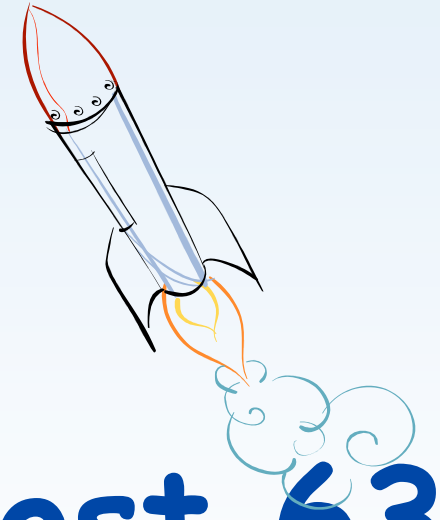
WELCOME





Explorers Post 630
Aeronautics

Glenn Research Center at Lewis Field

Advisors

NASA Glenn Research Center Volunteers

- **Leader: Sam Lee,** *Icing Branch-Research Engineer*
- **Paul Tsao,** *Icing Branch-Research Engineer*
- **Judy VanZante,** *Icing Branch-Research Engineer*
- **Jinho Lee,** *Combustion Branch Aerospace Engineer*
- **Lisa Rimpf,** *Graduate Research Assistant Combustion*
- **Stefanie Hirt**, *Inlets Branch Aerospace Engineer*

Agenda for Oct 4, 2004

- 5:05 ~ 5:20 Welcome/Quick Introduction
- 5:20 ~ 5:25 NASA background
- 5:25 ~ 5:55 Advisor introduction
- 5:55 ~ 6:00 Break
- 6:00 ~ 6:15 Plan for the year (Activities)
- 6:15 ~ 6:30 Q & A with the Family/Students
- 6:30 ~ 7:00 Student Introductions, etc ..

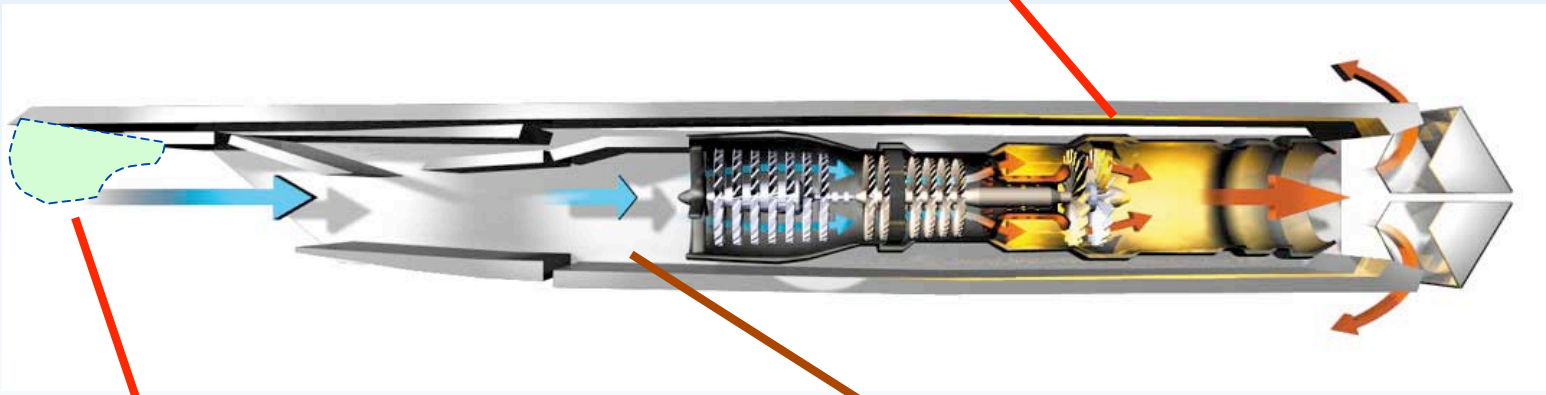
NASA Glenn RC

Glenn Research Center at Lewis Field

Who are we?

Jinho Lee PhD (Combustion Branch)

Lisa Rimpf (Combustion Branch)



Judith VanZante PhD (Icing Branch)

Stefanie Hirt, *Inlets Branch*

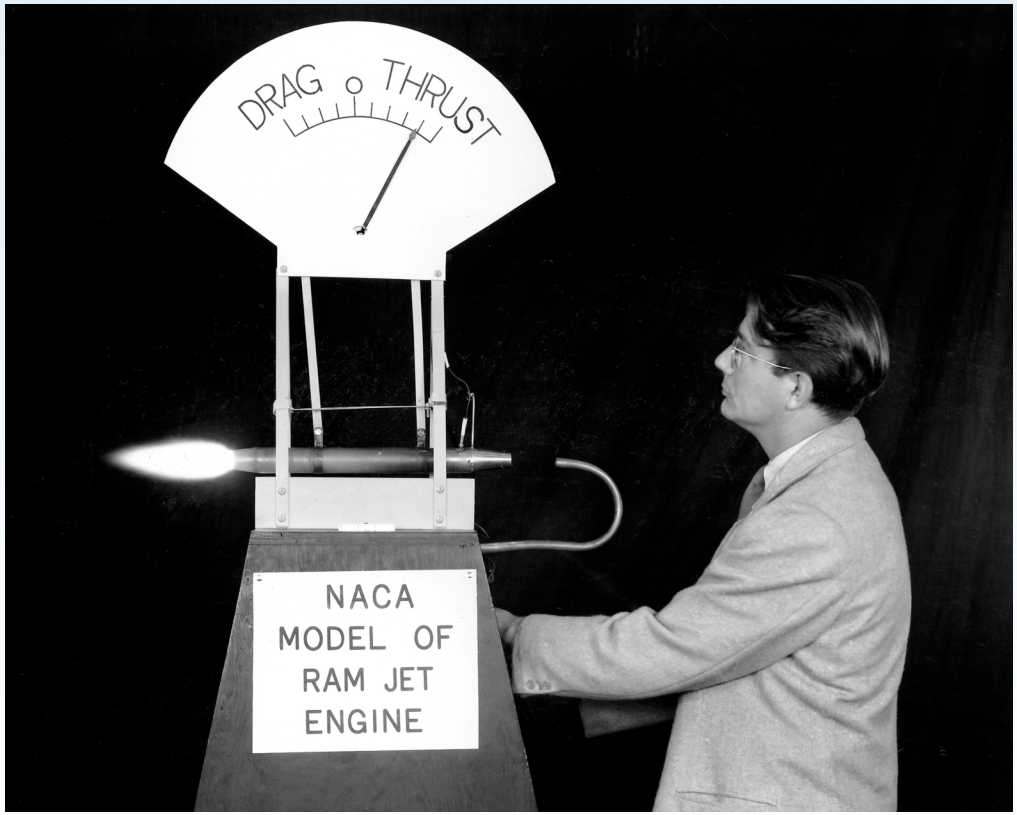
Sam Lee PhD (Icing Branch)

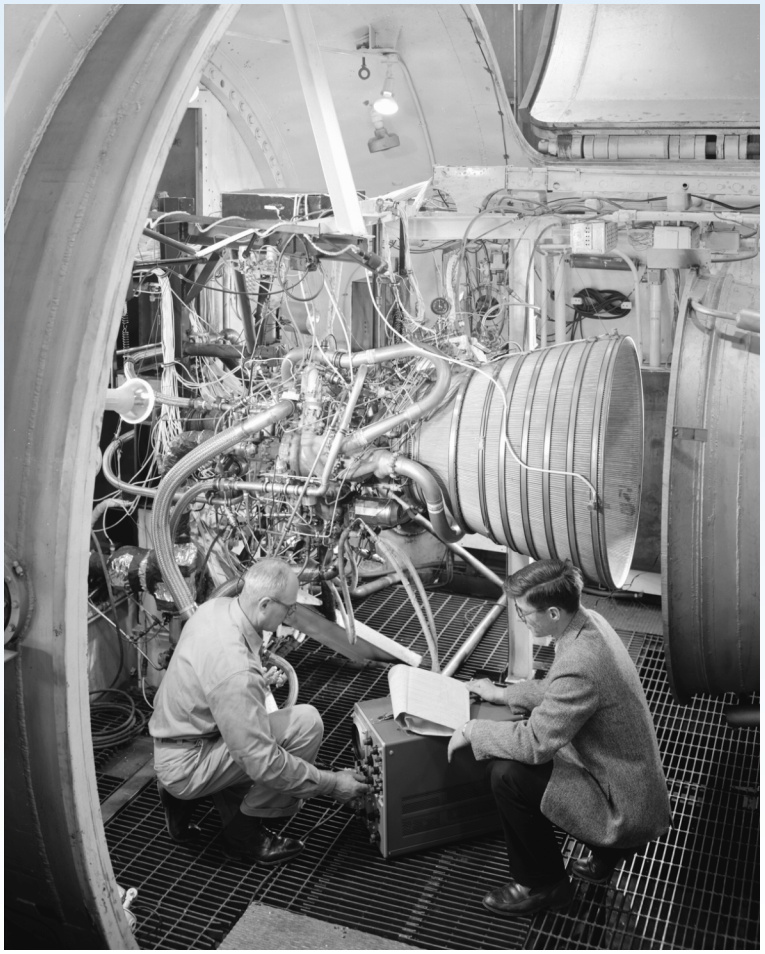

NASA centers and Missions
NASA
Ames Research Center
Dryden Flight
Research Center
Jet Propulsion Lab
Glenn
Research Center
USAFRL
NASA HQ / GSFC
Langley Research
Center
AMCOM
Marshall Space
Flight Center
Johnson Space
Center
Stennis Space
Center
Kennedy Space Center
NASA Center / Gov't Partner

This is NASA for general public

Engineering & Technology Exploring

NASA Glenn RC





Propulsion/Power

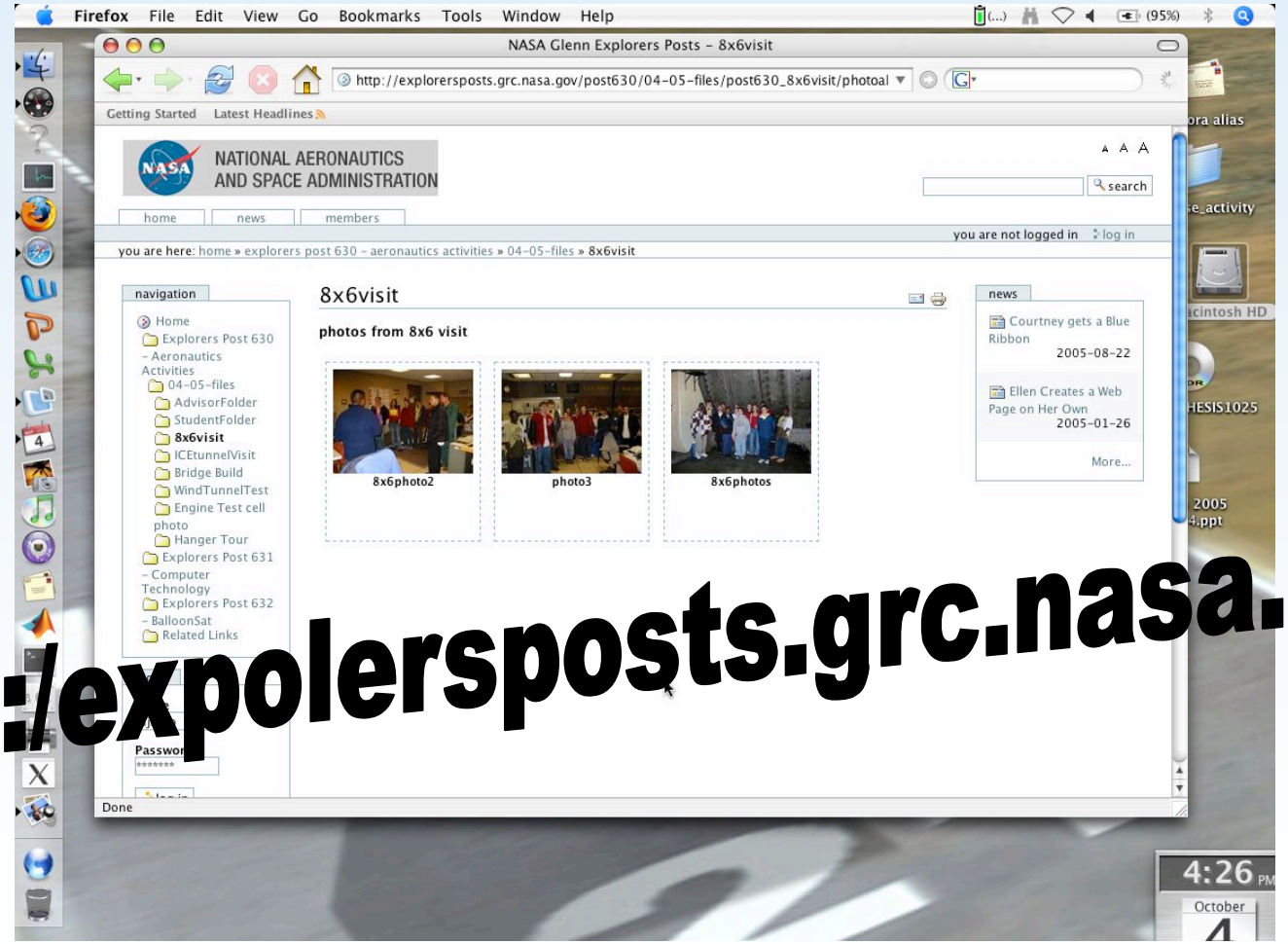
NASA

NASA Glenn RC

Glenn Research Center at Lewis Field

Questions (199?) ?

We do have a Web site for all of the Information shared



http:/expolersposts.grc.nasa.gov/

Sam Lee

Education

- B.S. Mechanical Engineering – Cornell University (1994)
- M.S. & Ph.D. Aerospace Engineering – University of Illinois (1997, 2001)

Job Assignment

- Research engineer for Aircraft Icing Branch
- Worked at NASA for 3 years
- Experimental studies on effects of in-flight icing on aircraft aerodynamics
- Wind tunnel and flight testing

Hobbies & Interests

- Photography, movies, video game, basketball

Cornell University
College of Engineering

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Paul Tsao

- **EDUCATION**
  - MS & Ph.D. Aerospace Engineering
    IOWA STATE UNIVERSITY

- **WORK**
  - Research Scientist for Aircraft Icing Branch
  - Theoretical Modeling of Ice Accretion Physics and Surface Water Transport Behaviors
  - Numerical Computation of Ice Growth and its Aerodynamic Effects on Aircrafts
  - Icing Scaling Test in the NASA GRC Icing Research Tunnel

Judy Van Zante

Education

- Graduate of Okemos, MI Public Schools
- B.S., Fluid & Thermal Sciences,
  Case Western Reserve University
- M.S. & Ph.D., Aerospace Engineering,
  University of Southern California

Career

Icing Branch / QSS

- Training pilots re hazards of aircraft icing (ground & in-flight)
- Icing Physics

Jinho Lee (Gin-Ho)

- Education -
  - Graduate of New York City Public School System.
  - B.S. and PhD Aero Engineering, State University of New York at Buffalo.
- Specialized Job Assignment - Computational Specialist for the Combustion Branch of Turbomachinery and Propulsions System Division.
  - CFD code development/Validation of Hypersonic Technology development
  - Principal Combustion Engineer for NASA's RBCC and TBCC programs
- Hobbies and Interests - High Speed flight, Model Airplanes, Playing with family and computers.

Lisa Rimpf

Olmsted Falls High School
June 1998

The University of Toledo

Bachelor of Science, Chemical Engineering, May 2003

Master of Science, Chemical Engineering, December 2005

Thesis Research: Commercial Aircraft Fuel Aviation Safety

Stefanie Hirt

BS Mechanical Engineering

Ohio Northern University, 2005

Inlet Branch

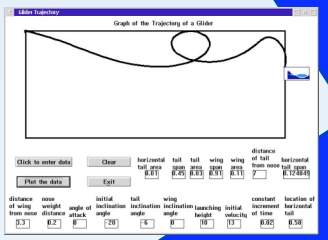
Co-op Student, 2002-2005

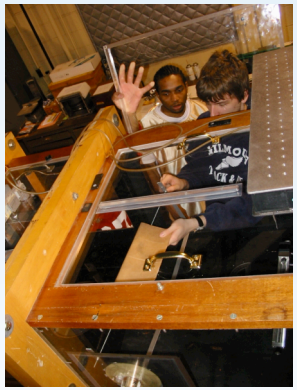
Hobbies

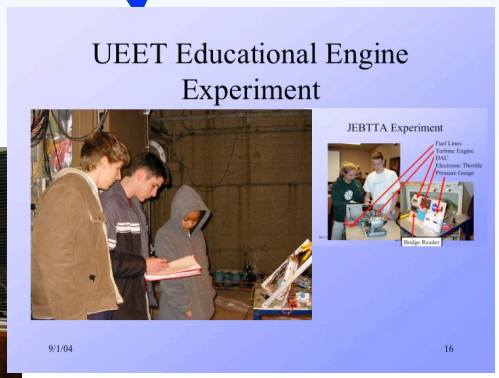
Reading, Games, Logic Puzzles

NASA-Aeronautics Explorer Post #630

How Planes Fly

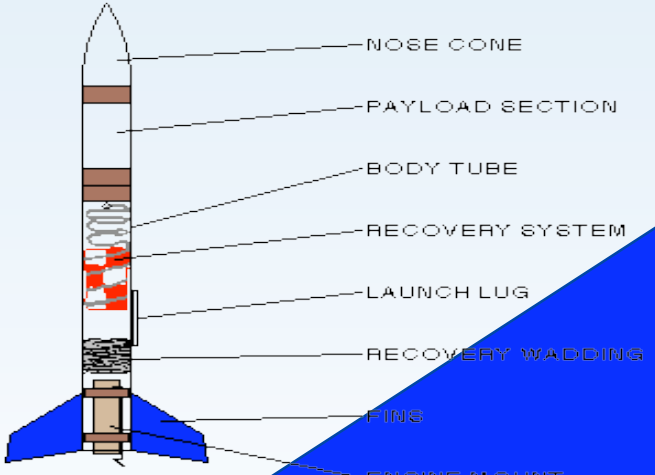


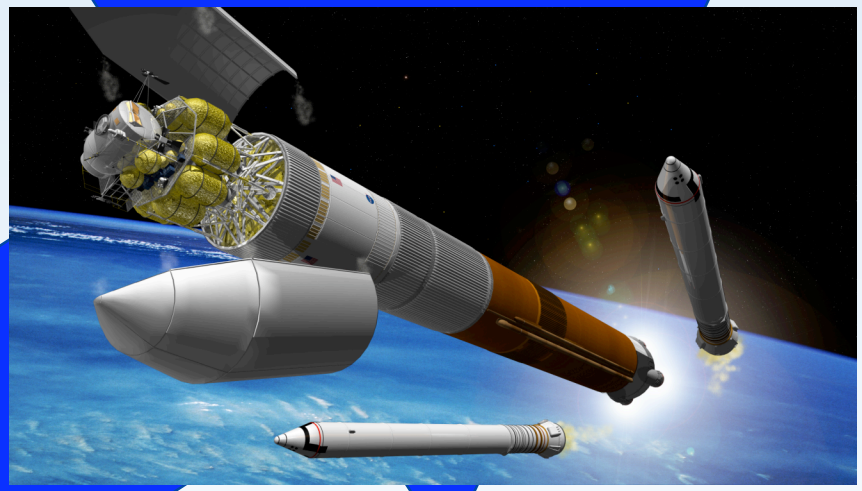


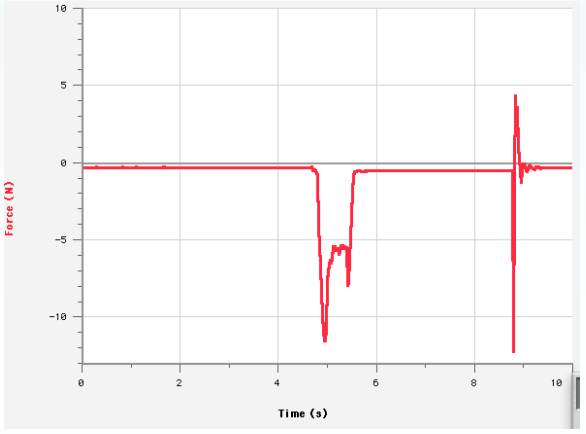


Aircraft Engine Basics

How to get off the ground







So, what is Explorers anyways?

A concept of the Boy Scouts of America, the purpose of Engineering Exploring is to provide the opportunity to examine engineering as a career choice and to participate in engineering activities.

We (advisors) are here to share with you (Scouts) our technical and engineering experiences

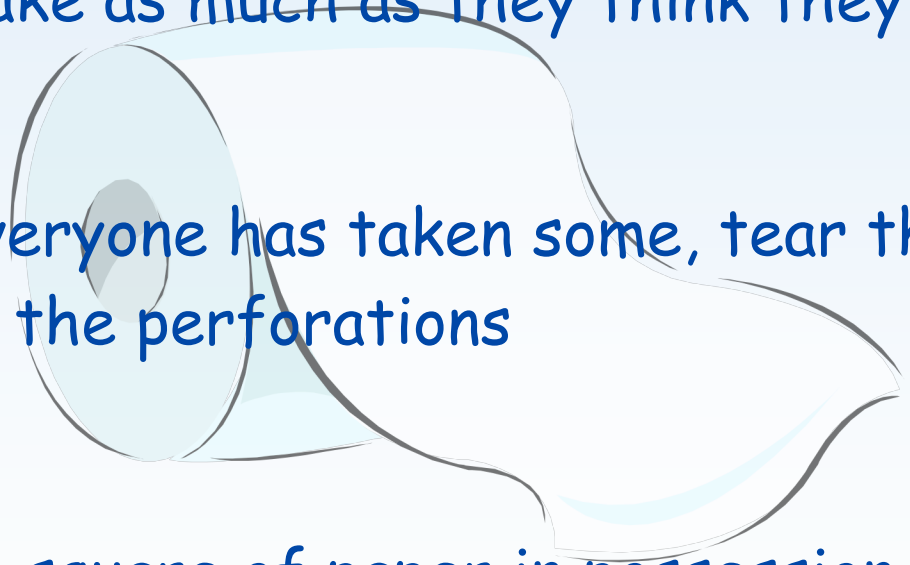
NOT A CLASS…you do that all day long – this is supposed to be educational and fun!

Now you can learn what happens "on the other side of the fence" at this NASA facility

This is a chance to find out that your current and future academics and studying will payoff *(trust us!)*

How much do you need?

- Pass around the roll of toilet paper… Each person should take as much as they think they might need



- After everyone has taken some, tear the toilet paper at the perforations
- For each square of paper in possession, you must share one fact about yourself

(examples: your name, school, pets, etc.)

Who are you??

- Everyone must have identification to enter the main gate
- Go directly to the designated meeting location
- ALWAYS have your Explorers badge with your name and picture while you are on the facility
- **Please no wandering**…you only have permission to use the restroom, cafeteria, and meeting room unless escorted

Remember, it is a privilege to be here, so please follow the rules

Expectations

- Please be on time arriving as well as departing
  (begin promptly at 5:00pm and end at 7:00pm)
- Be courteous to others

- Participate in discussions
- Always ask questions

- Turn ringers off on cell phones

Emergency Information

In the event of an EMERGENCY:

- Notify an advisor immediately
- From a NASA phone dial **911**
- From a cell phone or pay phone **216-433-8888**
- Know a way out of the room/building you are in

Safety is #1

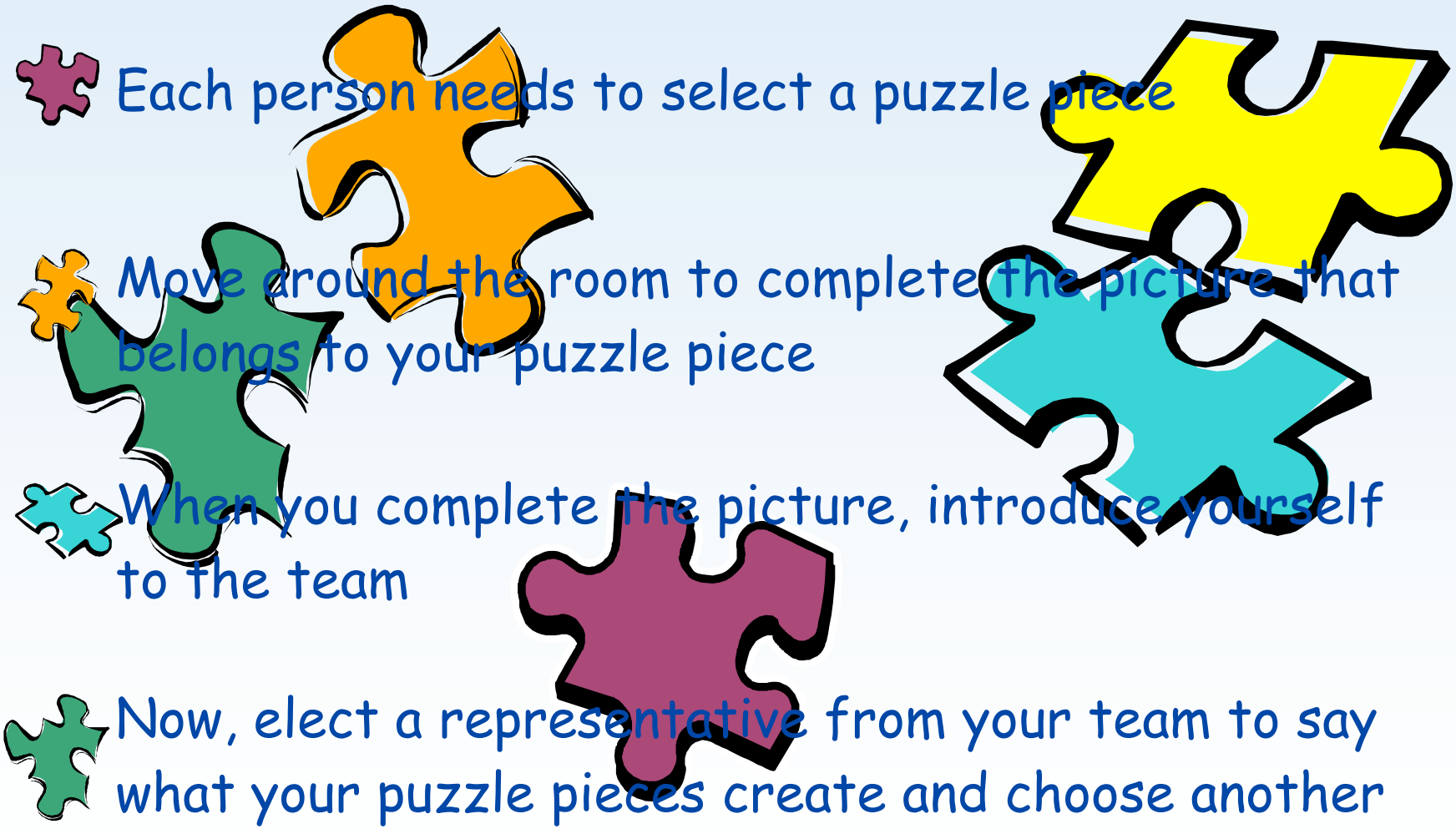
PLEASE DO NOT TOUCH

There are things around the center that can harm you if not careful…

High Voltage & Current

- Chemicals
- Sharp Objects
- Rotating Parts
- Hot/Cold Temperatures
- Lasers
- High Pressure Vessels
- Loud Noise Equipment

Puzzled – Snip Shots



- Each person needs to select a puzzle piece
- Move around the room to complete the picture that belongs to your puzzle piece
- When you complete the picture, introduce yourself to the team
- Now, elect a representative from your team to say what your puzzle pieces create and choose another member to restate all the names to the entire group

Aeronautics Definition

What is AERO·NAU·TICS ??

WHAT DO YOU THINK

Merriam-Webster says:

1) A science dealing with the operation of aircraft.

2) The art or science of flight.

Dictionary.com says:

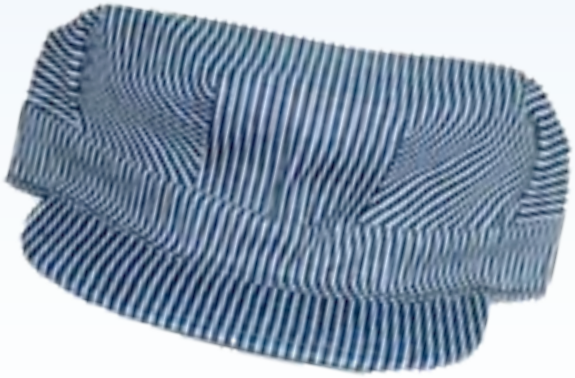
1) The design and construction of aircraft.

2) The theory and practice of aircraft navigation.

3) The theory and practice of navigation through air or space

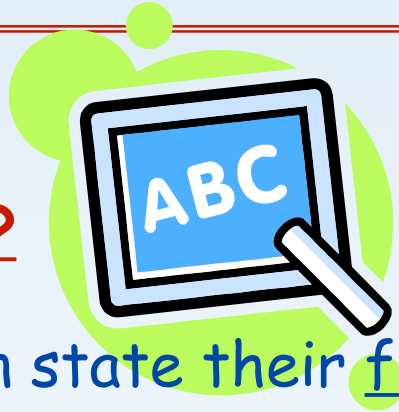
ENGINEER

So, do engineers drive trains?



What is an engineer?

Do you know your Alphabet?



So, what is everyone's name again?

Go around the room, and each person state their first name

Arrange yourselves in alphabetical order *(A to Z)*

BUT, here is the catch…you must do so **SILENTLY**

!! NO TALKING !!

Background Information

First Equation

Here is the first equation of many……

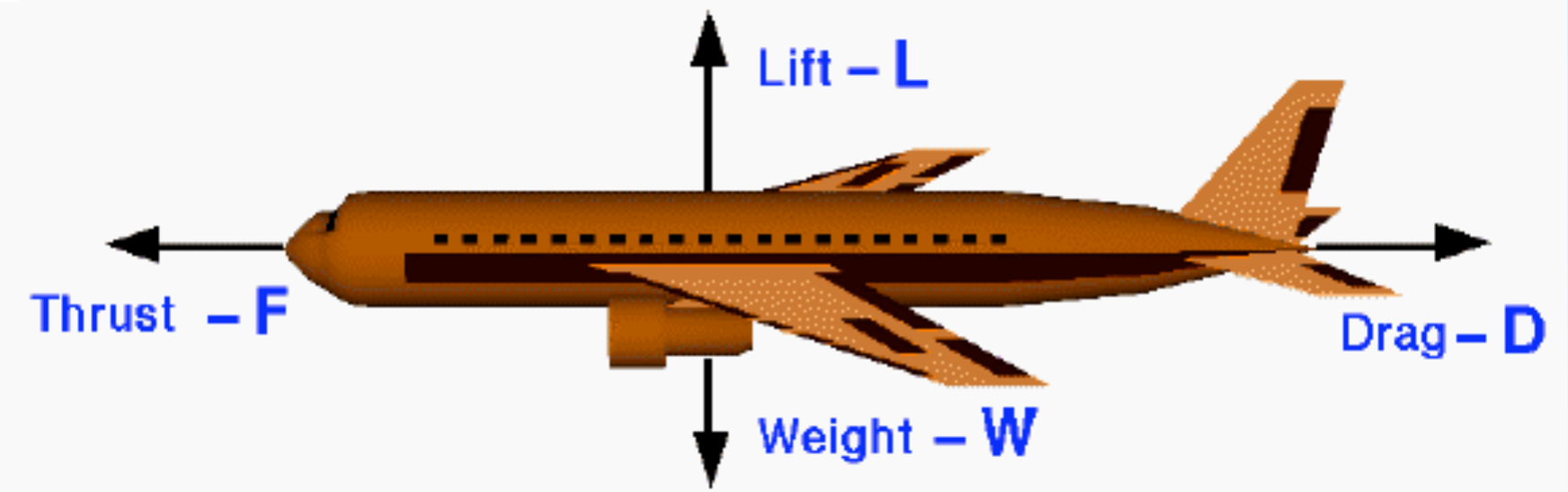
Have you seen it before?

$$F = (m)\cdot(a)$$

Newton's Second Law of Motion

The motion of an aircraft resulting from aerodynamic forces and the aircraft weight and thrust can be computed by using the second law of motion.

Four Forces



A force may be thought of as a push or pull in a specific direction.

A force is a vector quantity ⇒ both a magnitude and a direction

TOUR OPTIONS

NASA Glenn Center at Lewis Field

- NASA Glenn Visitor Center
- 8x6 Supersonic Wind Tunnel
- 9x15 Low Speed Wind Tunnel
- 10x10 Abe Silverstein Supersonic Wind Tunnel
- Icing Research Tunnel
- 2.2 Second Drop Tower
- Zero Gravity Drop Tower
- **Aero-Acoustic Propulsion Laboratory** (a.k.a. "The Dome")
- **Hangar** (Flight Research Building)

The Visitor Center

Learn about air and space travel and gain a new perspective on the universe in which we live.

Interactive exhibits and historic artifacts present basic principles of science and engineering and inform you about a broad spectrum of NASA's aerospace programs and their benefits to humanity.

8x6 Supersonic Wind Tunnel

Test section is 8 feet high x 6 feet wide x 23.5 feet long

Balance chamber surrounding the tunnel walls is used to provide boundary control of natural airflow into the tunnel through perforated holes within the tunnel walls

Low speeds: 0-Mach 0.1 and Mach 0.25-2.0

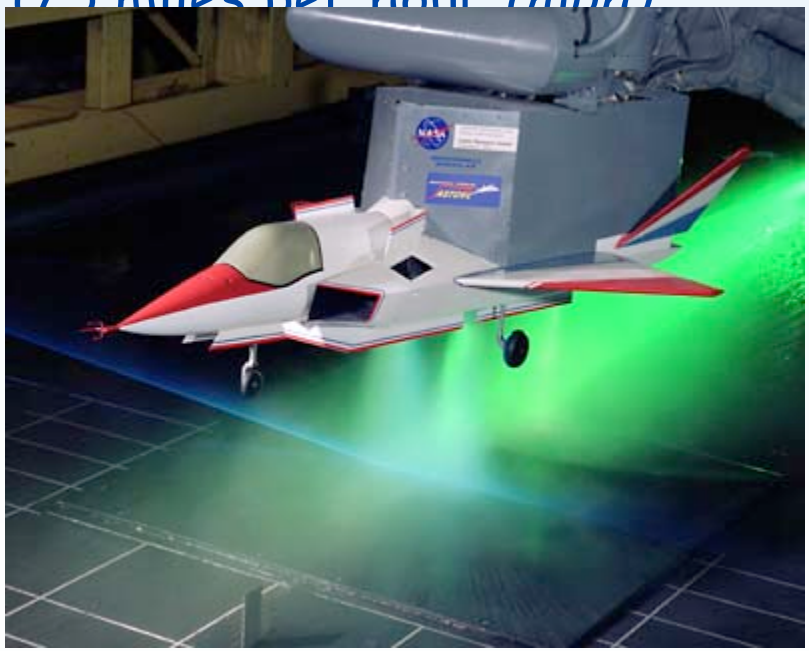
Operates either in an aerodynamic closed-loop cycle, testing aerodynamic performance, or in a propulsion open-loop cycle that tests live fuel burning engines and models.

9x15 Low Speed Wind Tunnel

Built in 1968

Test section is 9 feet high x 15 feet wide x and 28 feet long

Airspeeds from 0 to 175 miles per hour *(mph)*



8x6 and 9x15 Facility

**** Really just 1 field trip needed ****

The 8x6 and 9x15 tunnels are one facility and use the same equipment

click on box for movie

10x10 Abe Silverstein Supersonic Wind Tunnel

Test section is 10 feet high x 10 feet wide x 40 feet long

Unitary Plan Act, passed by Congress in 1949, was a coordinated facility construction that encompassed the National Advisory Committee for Aeronautics (NACA), Air Force, industry, and universities.

Brought on line in 1956, under the leadership of Dr. Abe Silverstein and Eugene Wasliewski

Can accommodate large-scale models, full-scale engines and aircraft components.

It can operate as a closed-loop system (aerodynamic cycle) or open-loop system (propulsion cycle), reaching test section speeds of Mach 2.0 to 3.5 and very low speeds from 0 to Mach 0.4.

Icing Research Tunnel (IRT)

Built at the end of World War II, the IRT is instrumental in developing and testing ice protection systems for aircraft.

Continuous airspeeds from 50-395 mph

Temperatures as low as -30°F

Test Section:
6 feet high x 9 feet wide x 20 feet long

2.2 Second Drop Tower

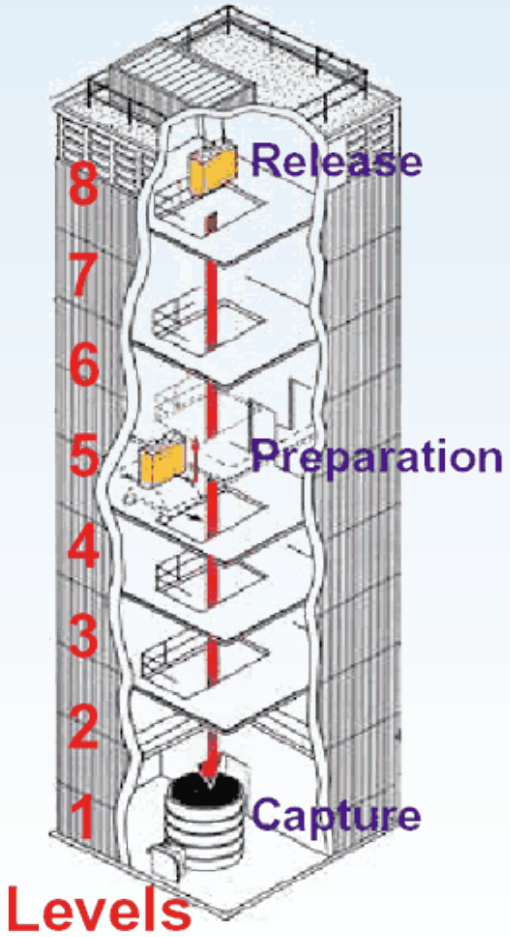
Microgravity, which is the condition of apparent weightlessness, can only be achieved on or near Earth by putting an object in a state of freefall.

Provides 2.2 seconds of microgravity

The package freefalls from the 8th floor to the 1st floor, a distance of 79 feet 1 inch.

Objects freely fall at the same gravitational acceleration, regardless of their mass

(9.8 meters per second squared) or (32 feet per second squared)



Zero Gravity Drop Tower

NASA's premier facility for conducting ground based microgravity research.

Larges facility of its kind within USA.

Operational since 1966.

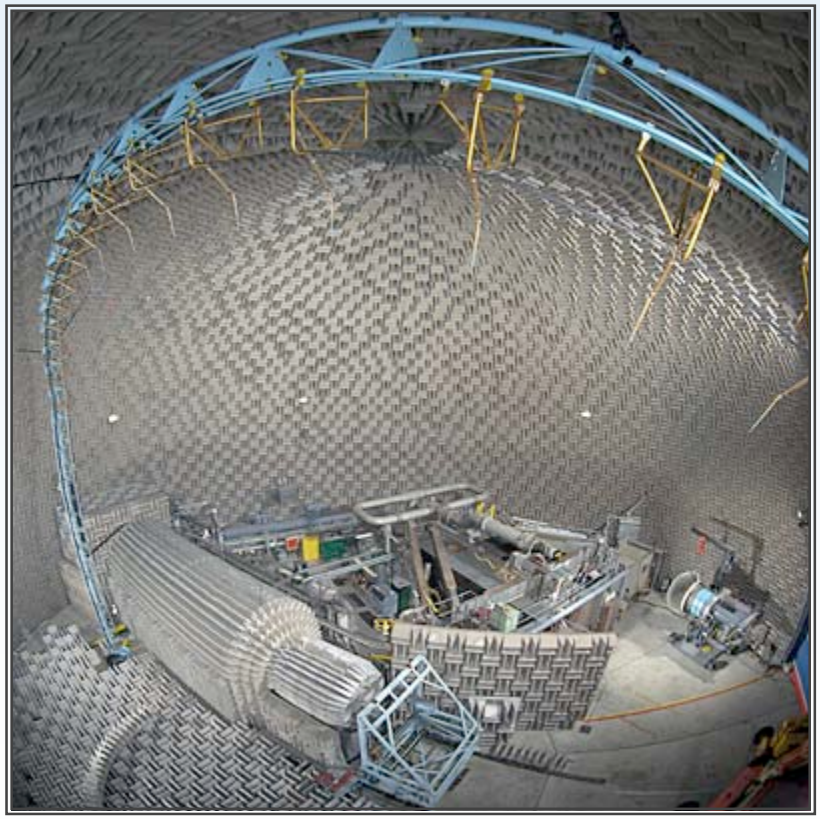
Near weightless environment for 5.18 seconds.

132 meter freefall distance inside a
140 meter steel vacuum chamber

The chamber is 6.1 meters in diameter, inside an 8.1 meter diameter concrete lined shaft that extends 155 meters below ground level.

Aero-Acoustic Propulsion Laboratory

(a.k.a. "The Dome")



Acoustically treated geodesic dome *(made of light straight structural elements mostly in tension).*

The 130-feet diameter dome is 65-feet high and acts as a noise barrier for adjacent buildings and nearby communities.

For researchers, the dome provides an anechoic *(free from echoes and reverberations)* testing environment for acoustic measurements of aeropropulsion components.

Hangar

Built in the 1940's

65 feet x 250 feet heated facility that is large enough to hold numerous aircraft

This is the facility that you can see from the road with the NASA logo

TOUR OPTIONS

NASA Plum Brook (Sandusky, Ohio)

- **Space Power Facility (SPF)**
- **Spacecraft Propulsion Research Facility (B-2)**
- **Cryogenic Research Tank Facility (K-Site)**
- **Cryogenic Components Laboratory (CCL)**
- **Hypersonic Tunnel Facility (HTF)**

NOTE: A tour of NASA Plum Brook facilities MUST be done on a Saturday and will require extra permission slips as well as transportation *(carpooling will be available)*

Space Power Facility

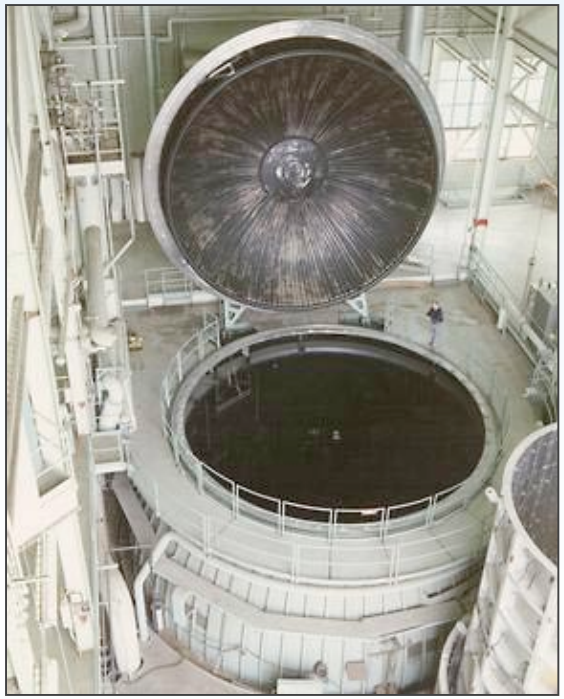
World's largest space environment simulation chamber
100 feet in diameter by 122 feet high Aluminum test chamber
Doors of the test chamber are 50 X 50 feet
Tested parts of rockets, Mars landers and space stations
The facility can sustain a high vacuum (10^{-6} torr); simulate solar radiation via a 4-MW quartz heat lamp array, solar spectrum by a 400-kW arc lamp, and cold environments (-320 °F) with a variable geometry cryogenic cold wall.

MARS PATHFINDER PROJECT
Date: 6/1/95

ATLAS V PAYLOAD FARING IN NASA PLUM BROOK STATION SPACE POWER FACILITY

Spacecraft Propulsion Research Facility

World's only test facility capable of full-scale rocket engine firings and launch vehicle system level tests at high-altitude conditions.



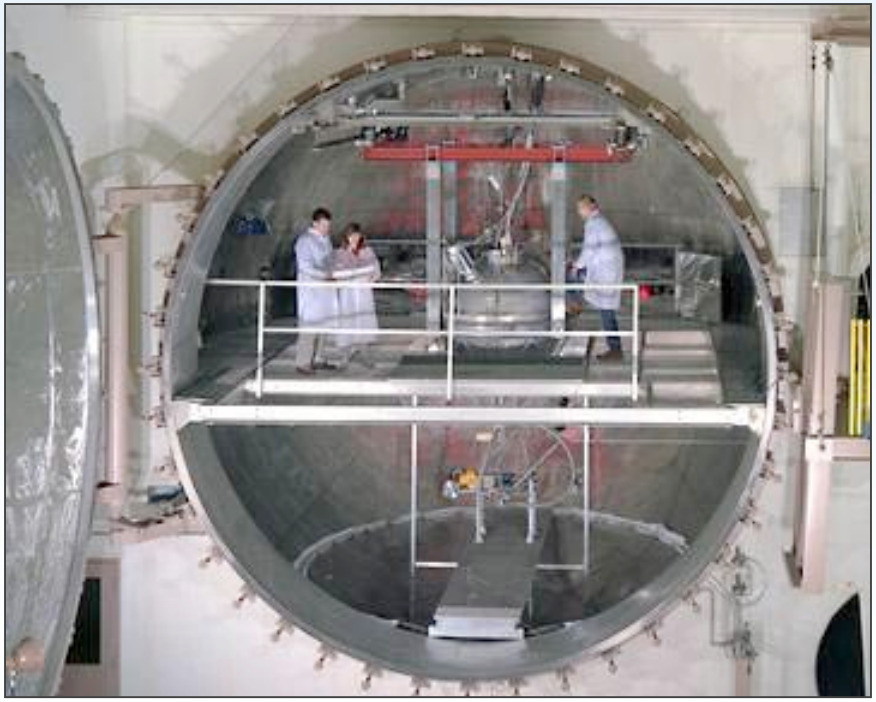
Vehicle engines producing up to 400,000-pounds of thrust can be fired for either single or multiple burn missions, utilizing either cyrogenic or storable fuels or oxidizers.

Cryogenic Test Complex

Cryogenic Research Tank Facility

&

Cryogenic Components Laboratory



Hypersonic Tunnel

A unique wind tunnel designed to test air-breathing propulsion systems at speeds exceeding 5 times the speed of sound.

Due to the high-energy nature of the facility, it is operated remotely from a control room approximately $\frac{1}{4}$ mile from the actual facility